

06-06-13; 7:01PM;

06-06-13; 04:34PM; 富士フイルム (古)

06-06-12; 1:58PM;

SUGHRUE (1)

NGR特許部

富士フイルム (古田)

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PAT 06/06/10-0112



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Docket No: Q80212

Shoichiro YASUNAMI, et al.

Appln. No.: 10/791,559

Group Art Unit: 1752

Confirmation No.: 3278

Examiner: Hoa Van Le

Filed: March 3, 2004

For: POSITIVE WORKING RESIST COMPOSITION

DECLARATION UNDER 37 C.F.R. § 1.132

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

I, Fumiyuki Nishiyama, hereby declare and state:

I am a citizen of Japan.

I graduated from Hokkaido University, Faculty of Science, Course of Physics in March 1989.

In April of 1989, I accepted employment with Fuji Photo Film Co., Ltd., and since then I have been engaged in research and development of photoresist photosensitive materials for semiconductors at the Yoshida-Minami Factory Research Division of Fuji.

I am familiar with the present application and I have reviewed the Office Actions dated January 13 and April 24, 2006.

A purpose of this Declaration is to provide evidence of the decomposition mechanisms of the photoacid generators (PAGs) of Uenishi et al USP 6,489,080 which the Examiner has pointed

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FROM SUGHRUE, MION

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out. The decomposition mechanisms of the PAGs in question are shown on the following page.

The underlined portions indicate the generated acids.

As is clearly seen from the decomposition mechanisms shown on the following page,  
none of the photoacid generators PAG 3-16, PAG 4-15, PAG 4-21 and PAG 4-31 of Uenishi et  
al generates a carboxylic acid.

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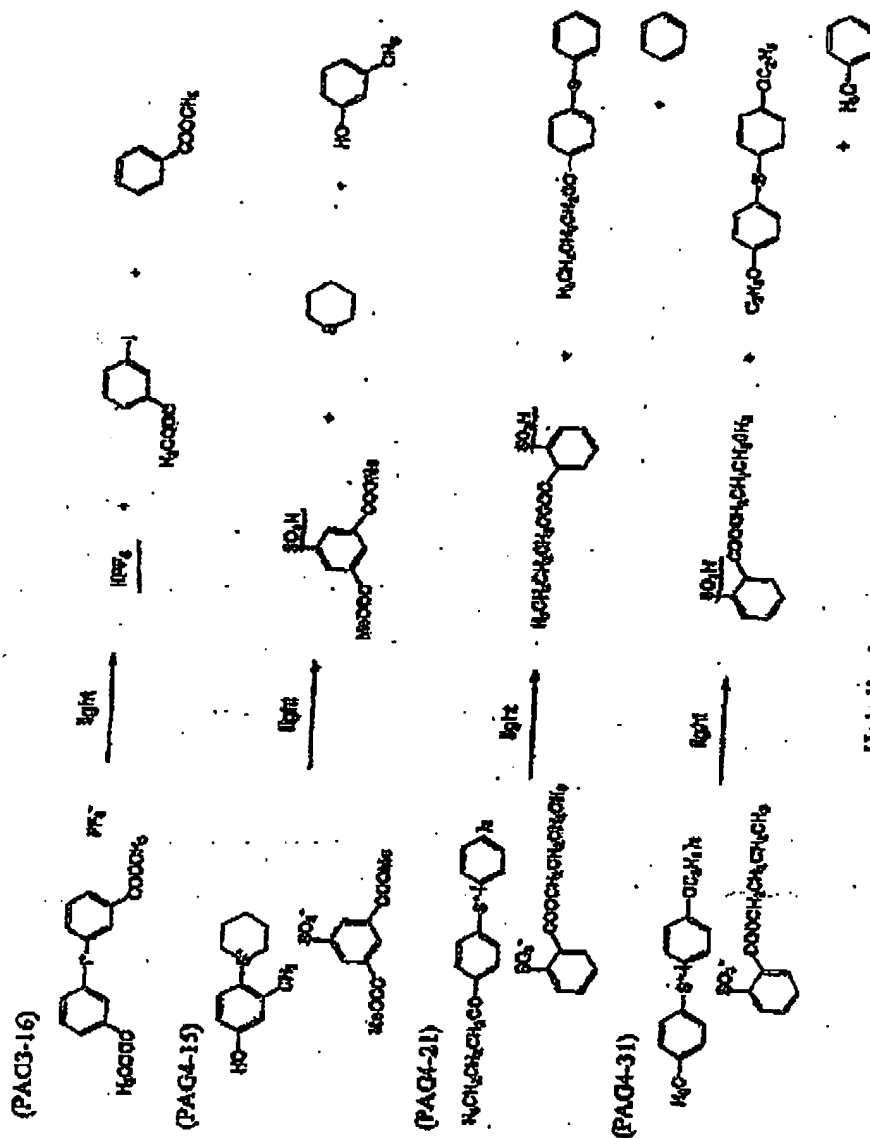
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A further purpose of this Declaration is to present evidence that the positive working resist composition of the present invention provides unexpectedly superior results in comparison to prior resist compositions.

In this regard, the following experiments were conducted by me or under my supervision. Examples a and b reported below provide experimental data demonstrating specific effects of the present invention. Both of Examples a and b employ a sulfonic acid generator in an amount within the scope of claim 1 of the present application. Comparative example a' demonstrates the difference between the present invention and Ishihara et al (US 2004/0033434). Comparative example a' employs Resin I described in Ishihara et al, which corresponds to a resin containing a repeating unit represented by formula (1) of the present application in which R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> represent a hydrogen atom; n represents 0; R<sub>4</sub> represents a methyl group; and Z represents C<sub>2</sub>H<sub>5</sub>. Resin I of Ishihara et al is outside the scope of formula (1) of present claim 1 because the C<sub>2</sub>H<sub>5</sub> group is outside the definition of Z in present claim 1.

#### EXPERIMENTATION

The composition preparation, coating, pattern formation and evaluation were carried out in the same manner as in the working examples of the present application as filed. The reference numbers and symbols in the present Declaration have the same meanings as in Mr. Shoichiro Yasunami's Declaration filed on November 17, 2005. Examples a and b shown in Table C below each employs a sulfonic acid generator in an amount within the range of the present claims. Comparative Example a' employs Resin I described in Ishihara et al (US 2004/0033434 A1), which corresponds to a resin containing a repeating unit represented by

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formula (1) in which  $R_1$ ,  $R_2$  and  $R_3$  represent a hydrogen atom;  $n$  represents 0;  $R_4$  represents a methyl group; and  $Z$  represents  $C_2H_5$ . As noted above, this  $Z$  group is outside the scope of present claim 1. The evaluation results are shown in Table D below.

Table C

	Resin	Sulfonic acid generator	Carboxylic acid generator	Nitrogen-containing basic compound
Ex. a	Resin A	PAG-A (5.5 wt%)	D-1 (0.4wt%)	E-1 (0.3 wt%)
Ex. b	Resin A	PAG-A (19.5 wt%)	D-1 (0.7wt%)	E-1 (0.3 wt%)
Comparative Ex. a'	Resin I	PAG-A (5.5 wt%)	D-1 (0.4wt%)	E-1 (0.3 wt%)

Table D

Example No.	Sensitivity ( $\mu C/cm^2$ )	Resolution ( $\mu m$ )	Pattern shape 3-Grade evaluation	Line edge roughness (nm)
Ex. a	7.0	0.09	Rectangular	5.3
Ex. b	3.5	0.09	Rectangular	4.2
Comparative Ex a'	8.0	0.10	Taper	7.0

From the comparative experimental data shown above in addition to the working examples of the present specification and the comparative experimental data in Mr. Yasunami's Declaration filed on November 17, 2005, it is understandable that the present invention provides superior effects.

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SUGHRUE (1)

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In the present Declaration, in accordance with the Examiner's point, Examples a and b have been added as data demonstrating the scope of the claims. From a comparison of Examples a and b with Comparative Example a' which employs Resin I of Ishihara et al, it is understandable that superior effects in terms of sensitivity, resolution, pattern shape and line edge roughness etc. can be achieved by using a specific resin and a sulfonic acid generator within a specific amount range, and further a carboxylic acid generator together. These superior results obtained with the positive working resist composition of the present invention would, in my opinion, have been unexpected to a person of ordinary skill in the photoresist art. Comparative Example a' employing Resin I of Ishihara et al cannot achieve the effects of the present invention.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 06/13/06

Fumiyuki Nishiyama  
Fumiyuki Nishiyama